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Utah Electrical Transmission Study

A Study of the Options and Benefits to Unlocking Utah's Resource Potential

January 21, 2021

Prepared for the Utah Governor's Office of Energy Development

Summary Presentation

Agenda

- 1-Slide Summary
- Study Background and Purpose
- Approach and Methods
- Results
- Findings and Discussion

Utah Transmission Study Recap

- **Goal of the study was to identify options and benefits to unlocking access to Utah's resource potential**
- **Utah's generation potential is a strength, but energy development activity will increase use of the transmission grid and buildouts of generation may become limited by transmission constraints**
  - Constraints along Utah's North-South transmission backbone are the most likely to limit the levels of generation and storage forecasted in this study
- **A transmission buildout of 290 line-miles of new and upgraded transmission can address these major constraints by 2030 and improve grid access for 5,000 MW of generation and energy storage capacity**
  - An alternative buildout of 210 line-miles helps to unlock 3,500 to 4,000 MW of new generation capacity
- **Investment in Utah's grid by 2030 has the potential to drive major economic development benefits within the state, including more than 20k temporary construction jobs, nearly 700 new permanent jobs, between $1.9 and $2.5 billion in local investment, and a one-time state tax revenue increase of more than $350 million**

Project Background

- **During the 2019 Utah Legislative Session, SB 3 allocated funds for an analysis of the Utah electrical transmission grid**
  - A Transmission Working Group (TWG) was formed to provide input and help guide the study process
  - The Utah Governor's Office of Energy Development facilitated the TWG
- **The Governor's Energy Office released an RFP in the spring of 2020 with the goal of contracting an analysis and subsequent report on the Utah transmission system**
  - Energy Strategies responded to the RFP and was awarded the contract
- **The goal of the study is to identify transmission constraints to accessing Utah's resource potential and identify options to address them**
  - Audience for the project includes both energy professionals and government officials

The study was motivated by potential transmission constraints to accessing Utah's in-state resources.

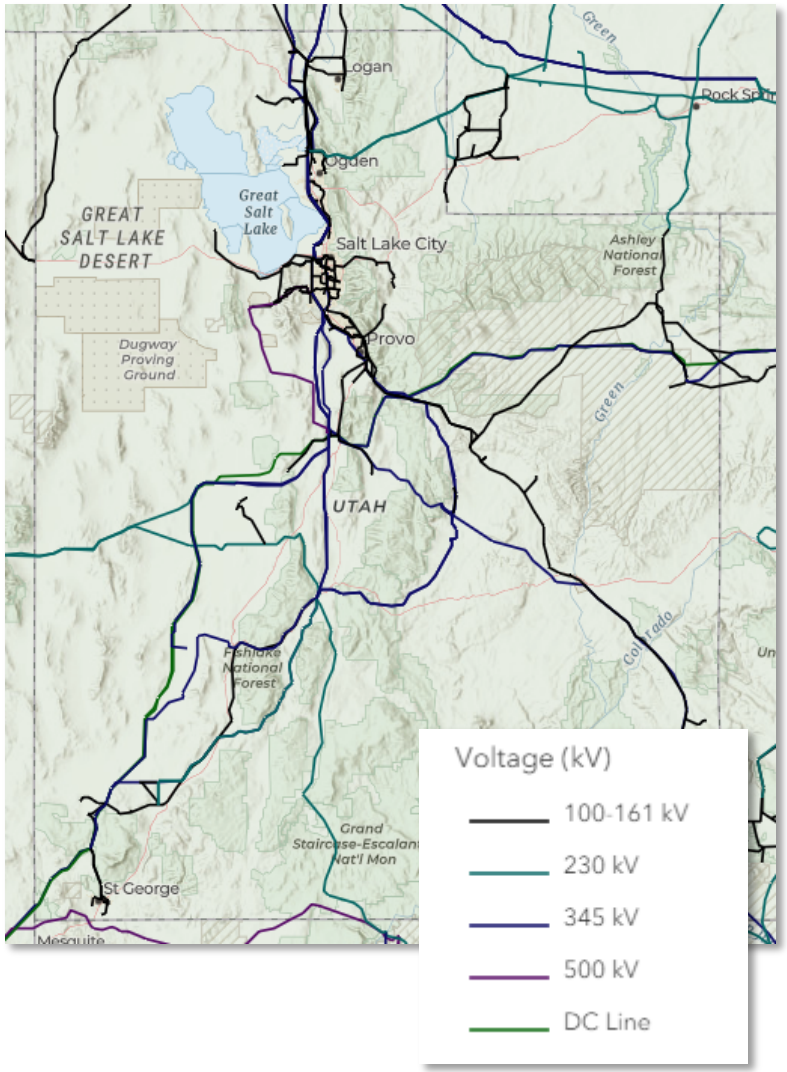
Project Goals

1. **Identify transmission constraints that limit access to Utah's energy resource potential**
2. **Provide strategies to address such constraints**
3. **Consider the costs, economic impact, and technical feasibility of proposed strategies**

Deliverables for the project include this summary presentation, an Executive Summary StoryMap available on the web, and a Technical Report. Deliverables are available at the Utah OED website at the following link:

Link to Deliverables

Existing Transmission in Utah



Approach and Methods

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Study Approach Was Designed to Identify and Evaluate Grid Constraints

1 Inventory Utah's Grid

- Gather data on existing transmission, planned transmission projects, transmission availability and capacity
- Compile maps and data summaries

2 Evaluate Future Needs

- Collect remaining data, including load forecasts and resource needs, interconnection queues, and transmission requests
- Develop and define Energy Resource Zones (ERZs)
- Develop three 20-year Resource Scenarios (Scenarios)

3 Identify Transmission Constraints

- Identify transmission constraints and limitations; also identify latent capacity on grid
- Perform research to inform model development and study work required
- Prepare study models to evaluate Scenarios against constraints
- Determine which constraints may limit delivery of resources located in ERZs

4 Evaluate Solutions

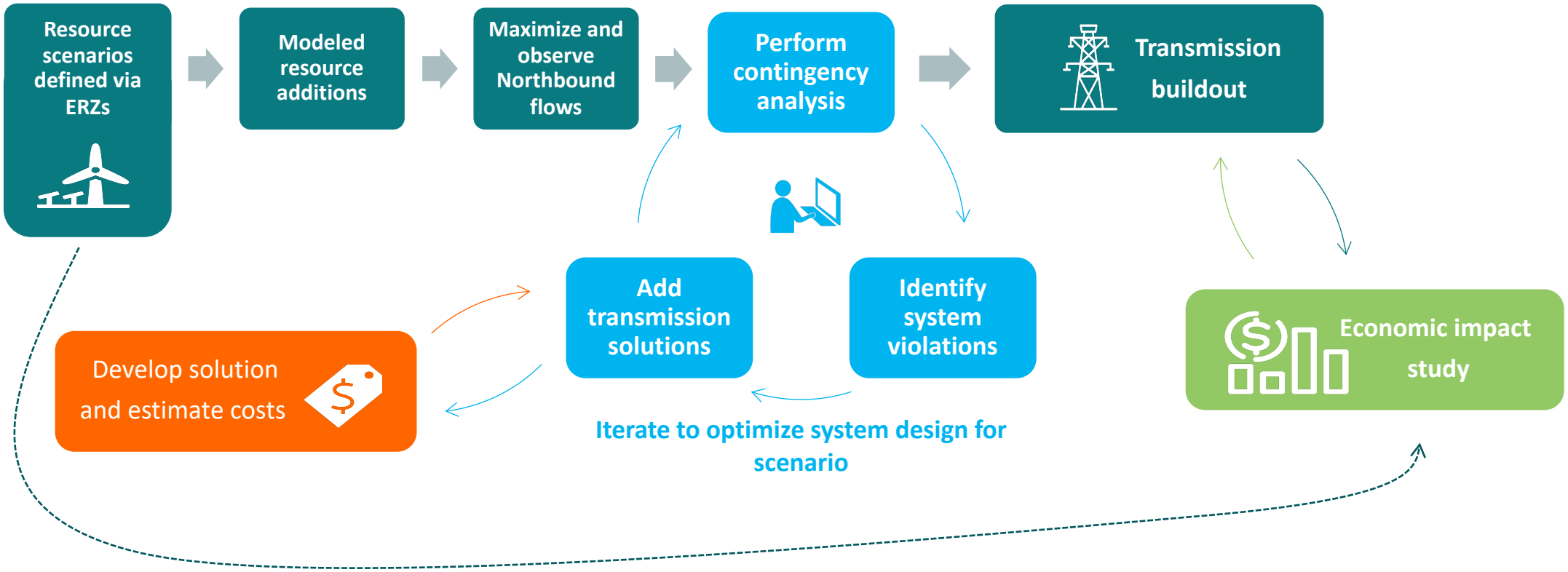
- Perform modeling to determine technical effectiveness of wire and non-wire transmission solutions at addressing transmission constraints
- Evaluate the cost effectiveness of technically viable solutions
- Estimate job and economic development impacts of resource additions and transmission solutions

5 Develop Recommen-dations

- Develop recommendations
- Prepare deliverable

Modeling Process to Identify Upgrades

Transmission build-outs to address constrained corridors were identified through an iterative power system modeling effort that took into account costs of potential high-voltage upgrades, their effectiveness, and the resulting economic development impacts of the transmission builds.



Study Results

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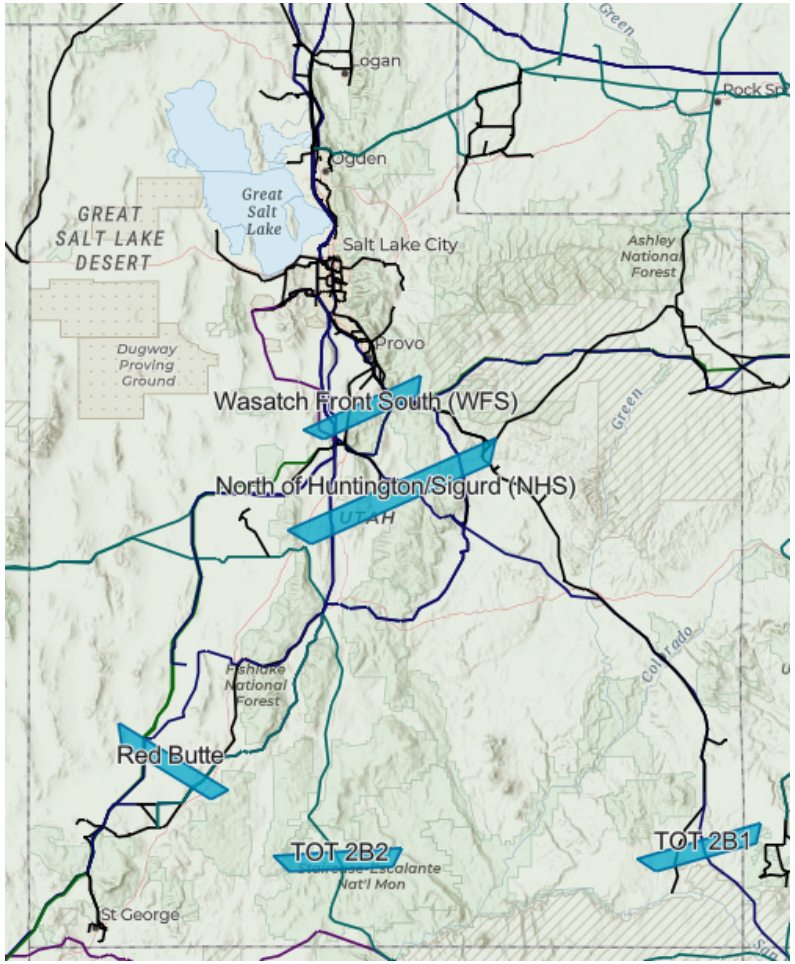
Key Results

- **Base, Mid, and High resource scenarios were developed for the 2025, 2030, and 2040 timeframes to forecast future capacity needs on the Utah grid**
  - ❖ Solar, wind, and storage were the primary resources additions based on data from utility resource plans
  - ❖ Results in capacity additions as high as 9 GW by 2040
- **Based on this in-state resource development and forecasted levels of transmission availability, Energy Strategies identified five potentially congested cut planes**
- **Power system modeling work sought to identify viable upgrades that could alleviate the identified constraints and deliver the resources in the scenarios to loads**

Potentially Congested Cutplanes

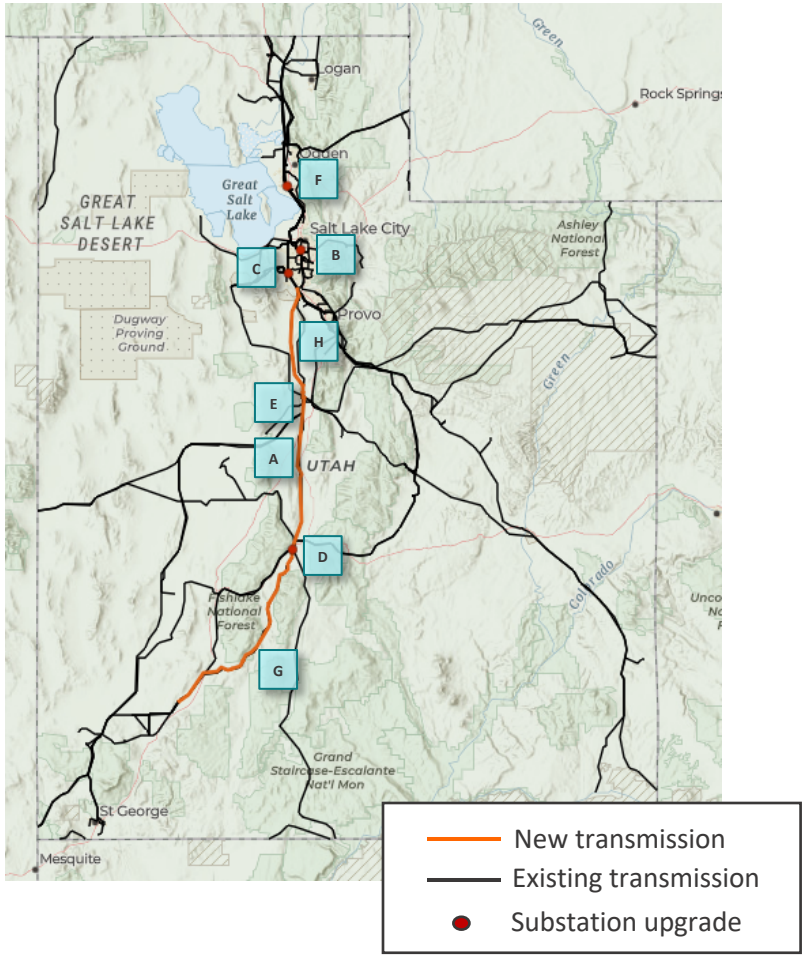


Viable Transmission Solutions: Baseline & Mid Resource Scenario

- **Additional generation capacity supported:** 3,530 to 4,040 MW
- **Line miles:** 210
- **Total cost of transmission:** $325 million
- **Special notes:**
  - Scope does not detail all substation or lower-voltage upgrades and analysis did not resolve all <200-kV transmission issues
  - Additional upgrades may be required depending on resource locations
  - Baseline and Mid scenarios resulted in same transmission build
  - Set up upgrades designed to mitigate most limiting contingencies

ID	Transmission Addition	Cost Estimate ($M)	Length (mi.)
A	New Sigurd - Clover 345 kV	128	67
B	New Midvalley 345/138 kV Transformer	13	-
C	New Oquirrh 345/138 kV Transformer	13	-
D	New Sigurd 345/230 kV Transformer	13	-
E	New Mona - Clover 345 kV	15	3.0
F	New Syracuse 345/138 kV Transformer	13	-
G	Parowan - Sigurd 230 kV Upgrade	38	94
H	New Mona - Camp Williams 345 kV	91	46

Transmission Buildout for Base/Mid Scenarios

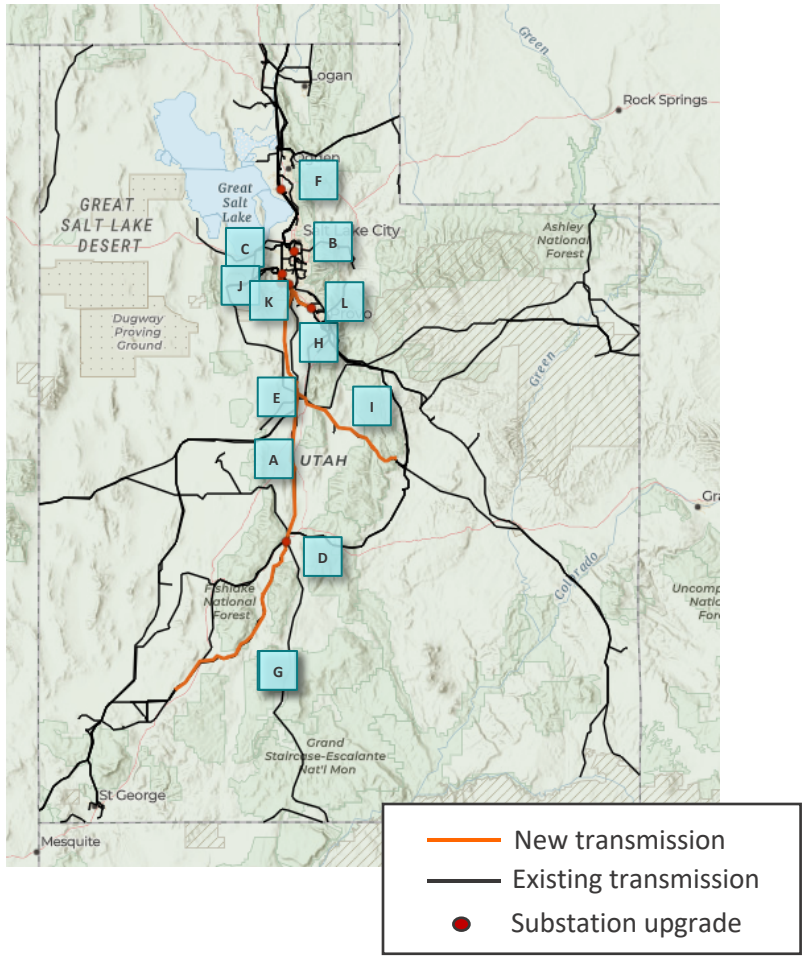


Viable Transmission Solutions: High Resource Scenario

- **Additional generation capacity supported:** 5,150 MW
- **Line miles:** 291
- **Total cost of transmission:** $578 million
- **Special notes:**
  - Scope does not detail all substation or lower-voltage upgrades and analysis did not resolve all <200-kV transmission issues
  - Additional upgrades may be required depending on resource locations

ID	Transmission Addition	Cost Estimate ($M)	Length (mi.)
A	New Sigurd - Clover 345 kV	128	67
B	New Midvalley 345/138 kV Transformer	13	-
C	New Oquirrh 345/138 kV Transformer	13	-
D	New Sigurd 345/230 kV Transformer	13	-
E	New Mona - Clover 345 kV	15	3
F	New Syracuse 345/138 kV Transformer	13	-
G	Parowan - Sigurd 230 kV Upgrade	38	94
H	New Mona - Camp Williams 345 kV	91	60
I	New Huntington - Mona 345 kV Line	115	46
J	New 126th S 345 kV expansion, 345 kV line, & 345/138 kV transformer	39	5
K	New Bangerter 345 kV expansion, 345 kV line, & 345/138 kV transformer	38	4
L	New TriCity 345 kV expansion, 345 kV line, & 345/138 kV transformer	60	13

Transmission Buildout for High Scenario

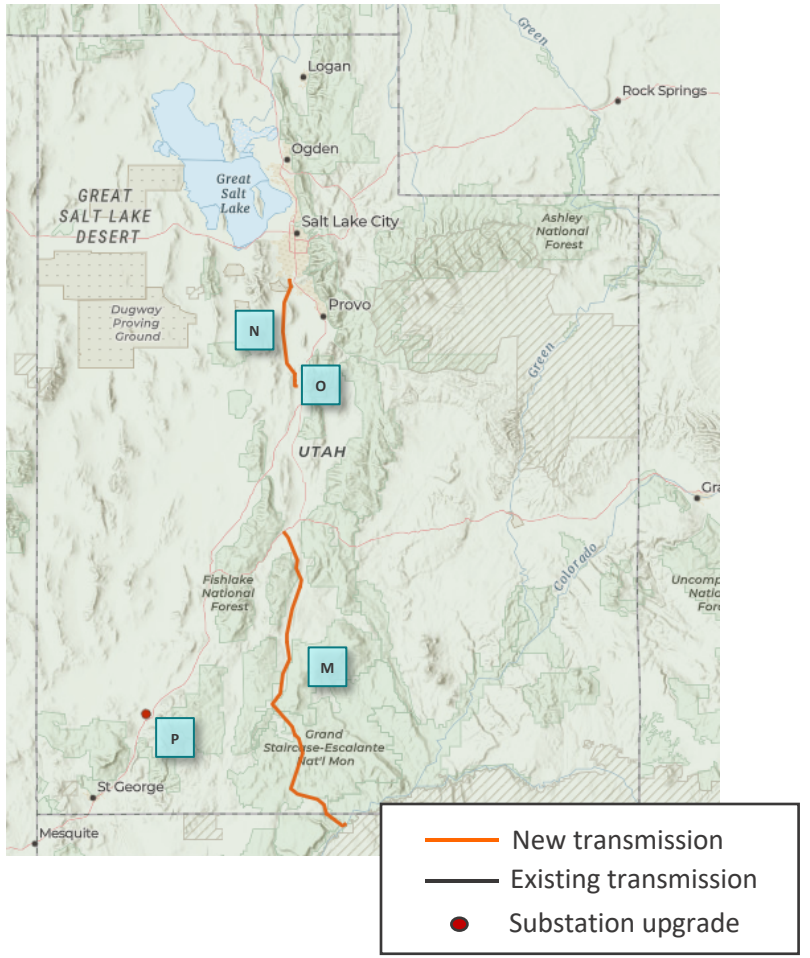


Viable Transmission Solutions: Additional Buildouts

- **Depending on how many resources are developed in the St. George and Four Corners areas, additional transmission may be required**
  - For example, if project economics support development near Red Butte instead of Mona, additional transmission may be needed
- **Sensitivity analysis identified four transmission solutions that help increase access to Southern Utah resources**
  - Assuming the transmission builds for the high resource scenario (prior slide) are built, the need for additional upgrades are triggered when Pinto development surpasses 260 MW, Glen Canyon additions surpass 325 MW, and St. George region development surpasses 825 MW
- **Total additional cost of $179 million adds additional 209 line miles of transmission**

ID	Transmission Addition	Resource Scenario	Cost Estimate ($M)	Length (mi.)
M	Upgrade Glen Canyon – Sigurd 230 kV Line	Pinto & Glen Canyon	65	160
N	New Mona - Camp Williams 345 kV	St. George	91	46
O	New Mona - Clover 345 kV	St. George	15	3
P	New Cedar 230/138 kV Transformer	St. George	9	0

Transmission Buildout for Alternate Scenarios



Economic Impact: 2030 Study Results

- The 2030 scenario **includes transmission and generation investments** and is the focus of the study's findings
- Investment in in-state generation and transmission is forecasted to provide significant economic development benefits to Utah

	Base	Mid	High
Local Investment in Utah ($M)	1,858	2,080	2,536
New Temporary Jobs (FTE-yr.)	19k	22k	27k
New Temporary Tax Revenue ($M)	$256	$287	$358
New Permanent Jobs	485	546	689
New Permanent Tax Revenue ($M)	$16	$19	$23

All values are in 2018$

Findings and Discussion

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Key Findings from the Study

1. **Utah has excellent electricity generation potential and energy development activity but future buildouts will increase congestion on the transmission grid**
   - Based on an analysis of resource plans and load forecasts, the Utah transmission system may need to accommodate between **5.5 to 9 GW of new power generation and energy storage by 2040**, which would roughly double the amount of installed capacity in the state
   - Utility resource plans indicate that wind, solar, and energy storage will be the primary generation types built in Utah
   - A major build-out of generation resources in Utah could lead to a **$3.6 billion** increase in state domestic product by 2040

2. **By 2025, resource buildouts will be limited by transmission constraints on key paths in Southern and Central Utah**
   - Plausible in-state buildouts of generation and storage considered in this study **will cause major congestion**
   - Transmission grid “pinch points" in Central Utah hamper access to resources in the central and southern half of the state
   - In addition, long lines that connect Central Utah to St. George, Glen Canyon, and Four Corners regions may also become congested under some buildouts
   - The severity of **congestion increases into the 2030s and 2040s** as increasing amount of new generation and storage will need to be delivered to loads

Key Findings from the Study (cont.)

3. **Transmission expansion along Utah's North-South transmission backbone will be required to address constraints and support levels of generation and storage buildout envisioned in this study**
   - Power system modeling confirmed that Utah's current and **planned grid cannot accommodate forecasted resource deployment** without new transmission upgrades
   - Non-wires options are not effective at providing the required magnitude of capacity

4. **A transmission buildout in Utah can help tap in-state resource potential**
   - This study identified a **transmission build that would unlock a significant portion of Utah's resource potential** and help meet forecasted in-state generation needs by 2030
   - The high resource scenario transmission buildout for 2030 adds **291 miles** of new and upgraded lines, costs approximately **$578 million,** and would help to access more than **5,000 MW** of new generation and storage capacity
   - A more modest in-state resource expansion of 3,500 to 4,000 MW was enabled through the addition of 210 line miles of transmission at a total cost of $325 million

5. **Major economic benefits accrue to Utah as a result of unlocking its resource potential**
   - Investments in transmission upgrades and new power generation has the potential to generate economic benefits for Utah's economy
   - The 2030 buildout could drive between **19,980 and 27,200 temporary construction jobs** and an additional **485 to 689 permanent jobs** in the state
   - In addition, the state could see between **$1.9 and $2.5 billion** in local investment, **$256 to $358 million** in additional one-time tax revenue and between **$16 and $23 million** in permanent annual tax revenue

Study Observations

In addition to the findings above, the analysis and supporting research led to a number of observations that could impact future generation and transmission buildouts in Utah

1. **Should Utah's utilities transition to participation in an organized energy market (such as an RTO), physical constraints, instead of the commercial constraints evaluated in this study, would be a more appropriate means for identifying constrained corridors**

2. **The study conservatively assumed that 100% of the nameplate capacity of new resources must be fully deliverable. The amount of transmission upgrades identified would decrease if weather-dependent resources like wind and solar were assumed to have lower dispatch levels consistent with their typical output during stressed conditions**
   - Since the goal of this work was to identify corridor upgrades to mitigate constraints, the study adopted this conservative analytical approach which focuses on pure capacity additions
   - In addition, certain transmission upgrades may be avoided if new generators were delivered to loads using rights currently used by transmission customers for other purposes

3. **A 500-kV build option could be further studied with neighboring states**
   - There could be interregional benefits to completing a 500-kV loop, connecting new Clover 500-kV substation in Central Utah with either Nevada, Arizona/New Mexico 500-kV backbone systems
   - Such expansion would create a transmission "superhighway" connection between Wyoming and Southwest with Utah as key on/off-ramp
   - This option was significantly more expensive than solutions presented in this study, but if broader benefits or regionally-focused scenarios were considered, higher-voltage upgrades may be beneficial to the system and region

4. **Development in West Desert (Path 32) requires upgrades and was not a focus of study**
   - ERZs in the West Desert showed initial promise of accommodating new resources, however the 230 kV system is fairly limited in this area and the cost of accessing the area was high relative to the assumed level of resource development
   - Construction of transmission lines between the Sigurd 345 kV substation and Gonder 345 kV substation located in Nevada could allow for additional integration of renewables

5. **The transmission buildouts presented in this study represent only a portion of the transmission costs required to interconnect and fully deliver resources**
   - Additional upgrades may be required to collect, interconnect, and deliver resources to loads

6. **The magnitude of southern Utah transmission upgrades depends on resource development in the area**
   - There is very limited capacity available to add resources in the St. George, Glen Canyon, and Four Corners resource zones
   - If resources are deployed in significant amount in these areas, major lines must be constructed along several transmission corridors in Southern Utah and such conceptual lines were identified in this study

Study Considerations & Caveats

The following add context to the study results and how they should be interpreted.

1. **This study is not intended as a cost-benefit analysis and is not an optimized build-out nor a "construction plan"**
   - The study considers the cost of transmission, as well as the economic development benefits of new resources and transmission construction/operation, but it does not include an electric-sector focused benefit vs. cost analysis that might be used to consider investment tradeoffs and would include additional benefit categories.

2. **This study does <u>not</u> supplant local or regional transmission planning analyses and plans**
   - Transmission providers in Utah have federally-regulated obligations around providing different types of transmission service and interconnection service to customers and retail load. This analysis does not consider all aspects of such obligations and is focused on a high-level assessment of the magnitude of potential transmission needs to increase access to Utah generation.
   - There may be alternative or more effective transmission options not identified in this study
     - Corridors may be space-limited, which could drive alternative transmission lines or configurations
     - Substation expansions to accommodate new transmission addition may be limited, which could drive alternative transmission lines or configurations
     - Study did include comprehensive permitting risk assessment and instead used a simplified tool
   - Transmission may be required sooner or later than what is demonstrated in this scenario-based study.
   - Generally, the study was performed at a high-level focusing on major transmission constraints on the system. It does not capture all potential interconnection upgrades or low-voltage upgrades.

3. **Study does not replace or replicate individual utility resource planning efforts**
   - Individual utilities perform integrated resource planning to meet state requirements or otherwise optimize their generation resources, and this study used that information to the extent it was available. However, while this study sought to determine where the resource identified by these utilities might be best sited, but does not replace those more detailed assessments.

4. **Study did not focus on opportunities for Utah to develop transmission that facilitates export of generation to neighboring states**
   - Such analyses would have identified a different set of transmission solutions and would require consideration of a broader set of benefits
   - This study focused on the in-state transmission solutions required to meet in-state resource development. While many of Utah's transmission corridors connect with neighboring states' transmission systems, the focus of this study included only in-state resource development, transmission solutions, and economic benefits to the State of Utah.

5. **The results and findings herein are not designed to apply to a particular generator, nor do the represent transmission solutions to a particular system performance issues that may be observed in planning studies**

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THANK YOU

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